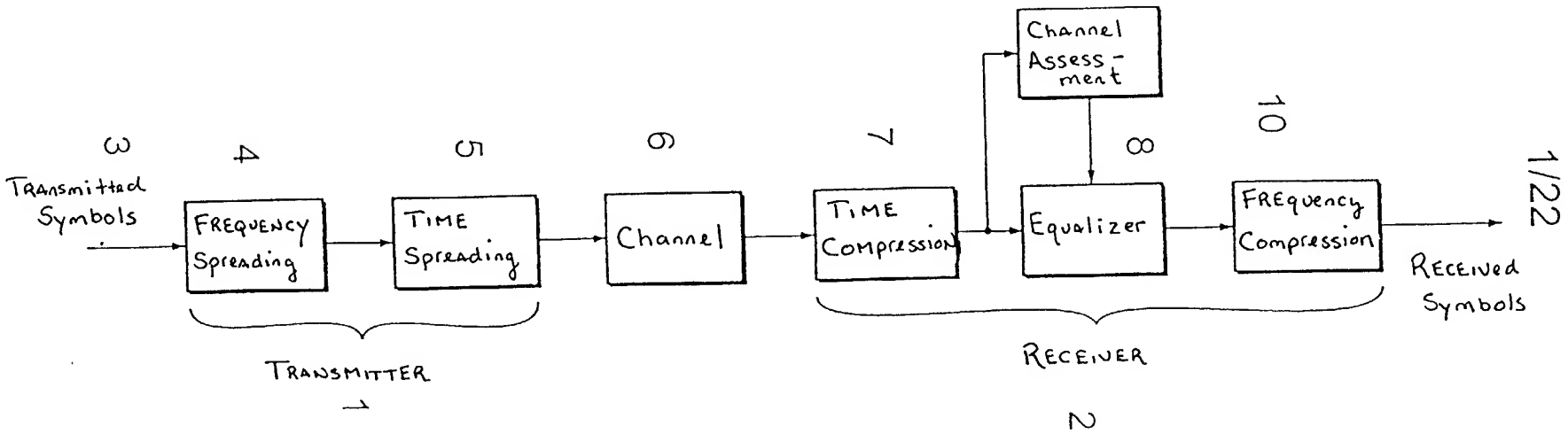


Fig. 1

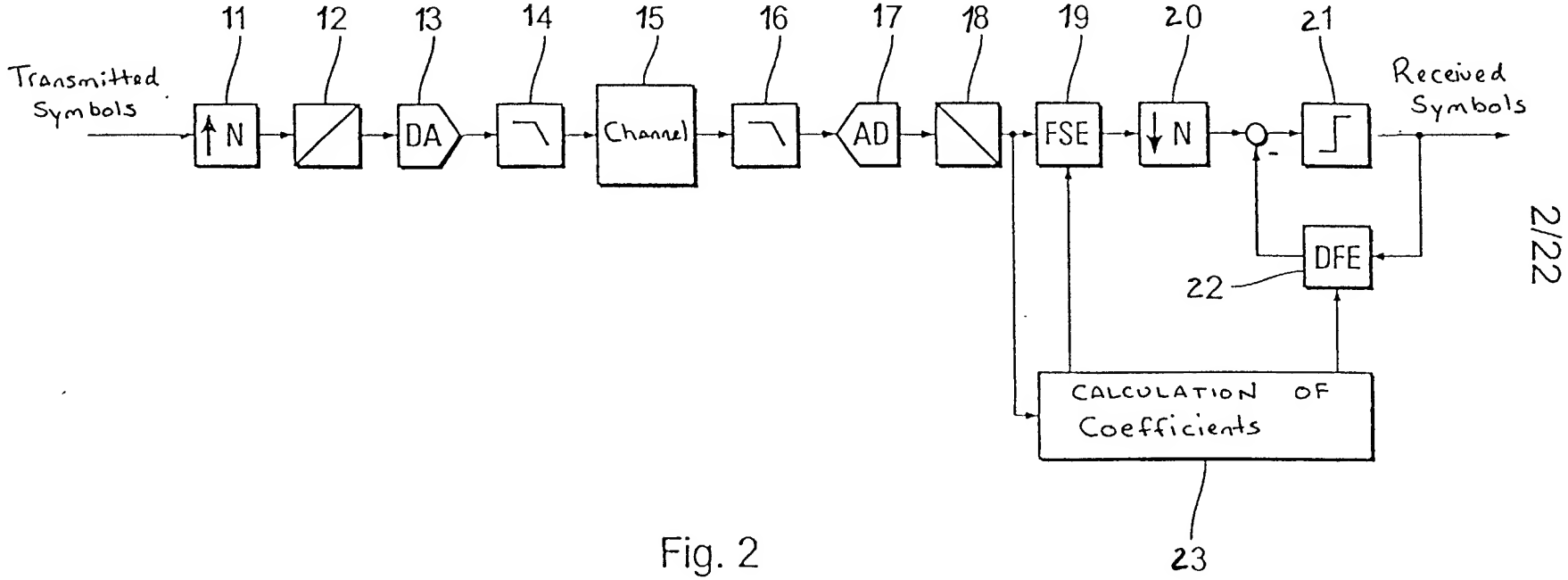

11
12
13
14
15
16
17
18
19
20
21
Transmitted Symbols
N
DA
Channel
AD
FSE
N
-
Received Symbols
DFE
22
CALCULATION OF Coefficients
23

Fig. 2

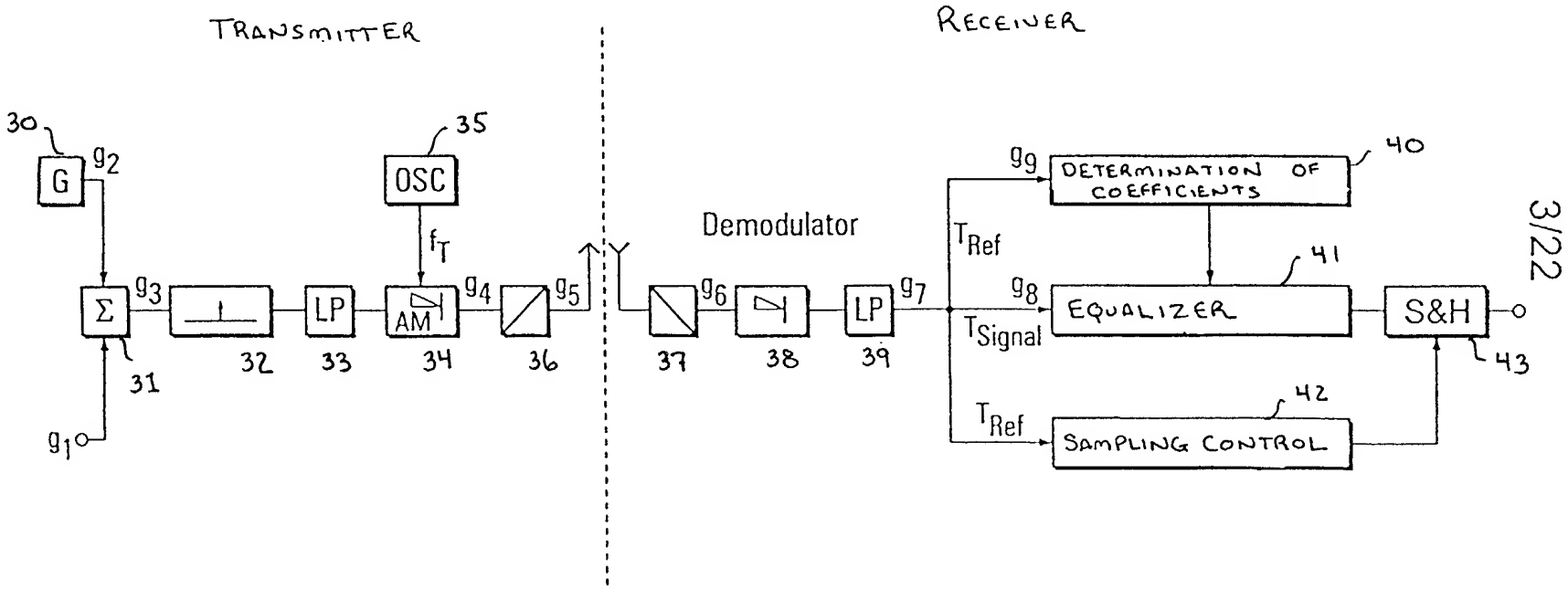

TRANSMITTER
RECEIVER
30
G
g_2
35
OSC
f_T
g_1
Σ
31
g_3
32
LP
33
AM
34
g_4
36
g_5
Demodulator
37
g_6
38
LP
39
g_7
g_9
DETERMINATION OF COEFFICIENTS
40
T_{Ref}
g_8
EQUALIZER
41
S&H
43
T_{Signal}
T_{Ref}
SAMPLING CONTROL
42

Fig. 3

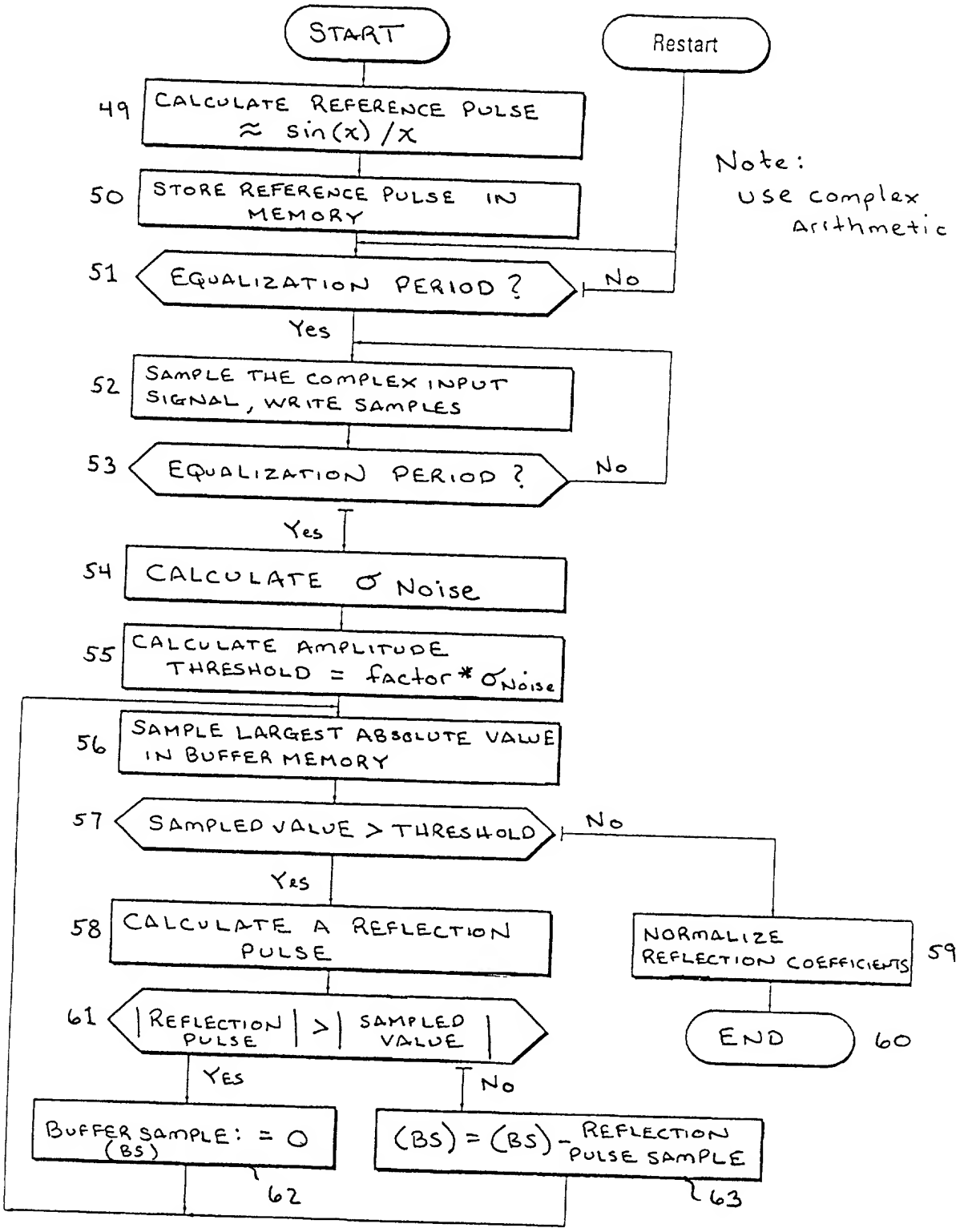

START
Restart
49 CALCULATE REFERENCE PULSE ≈ sin(x)/x
50 STORE REFERENCE PULSE IN MEMORY
Note: use complex Arithmetic
51 EQUALIZATION PERIOD ?
No
Yes
52 SAMPLE THE COMPLEX INPUT SIGNAL, WRITE SAMPLES
53 EQUALIZATION PERIOD ?
No
Yes
54 CALCULATE σ Noise
55 CALCULATE AMPLITUDE THRESHOLD = factor * σNoise
56 SAMPLE LARGEST ABSOLUTE VALUE IN BUFFER MEMORY
57 SAMPLED VALUE > THRESHOLD
No
Yes
58 CALCULATE A REFLECTION PULSE
NORMALIZE REFLECTION COEFFICIENTS
59
END
60
61 |REFLECTION PULSE| > |SAMPLED VALUE|
Yes
No
BUFFER SAMPLE (BS) := 0
62
(BS) = (BS) - REFLECTION PULSE SAMPLE
63

Fig. 7

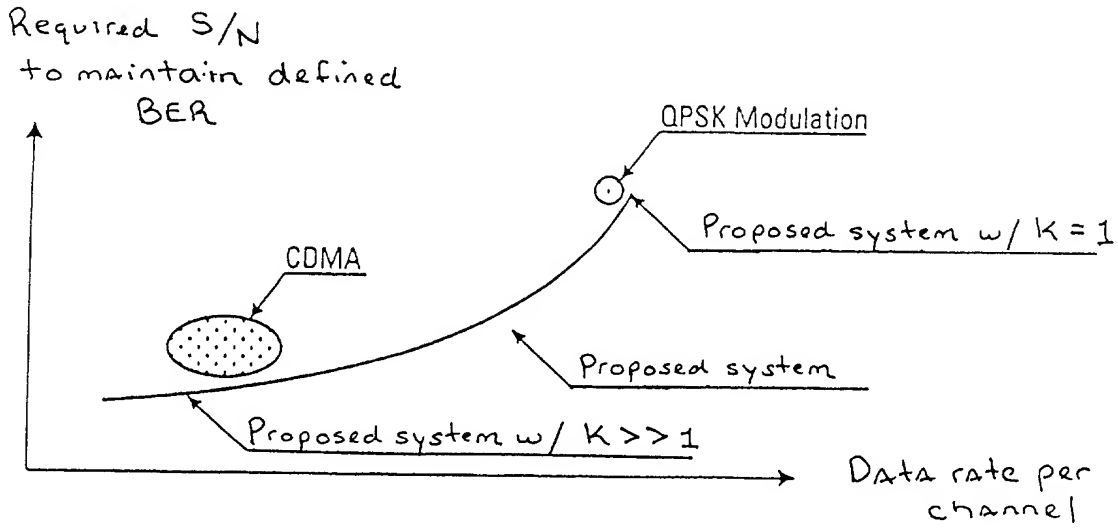


Fig. 9.1a

Simple modification of the K value, represents the difference in time between

$\Delta t = k \cdot \delta$

Example:

Constant transmitter power P_{xmit}

Case 1: k = 10

Case 2: k = 4

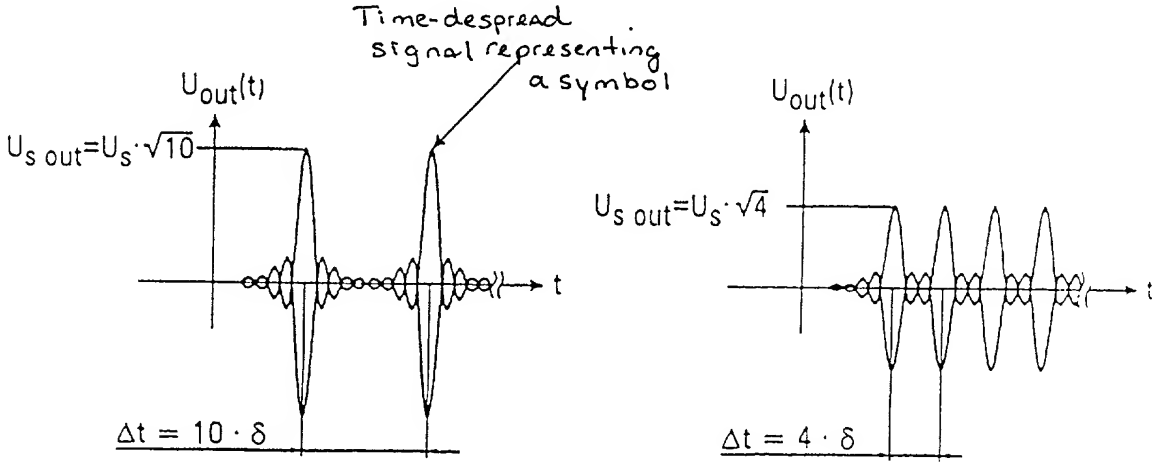
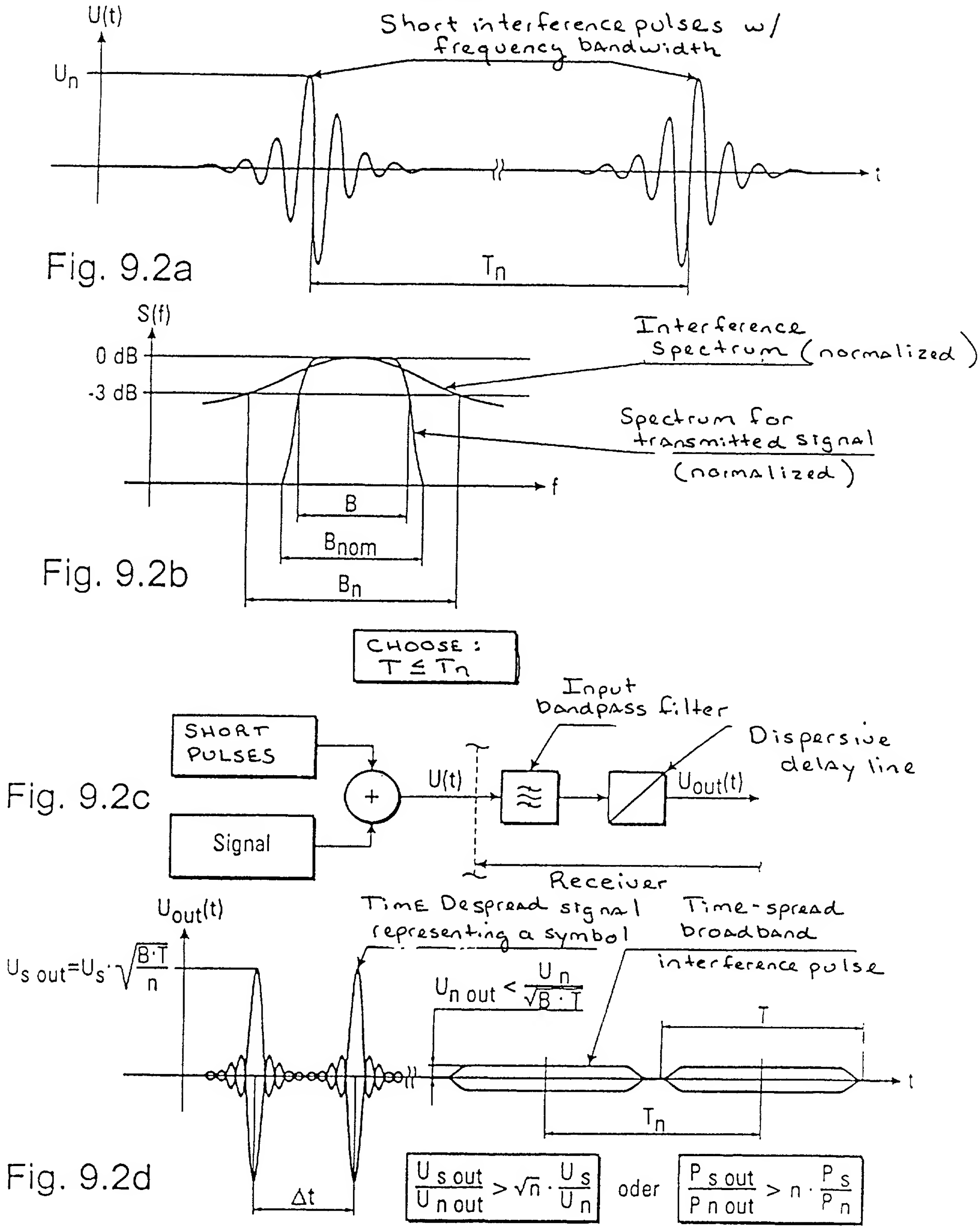


Fig. 9.1b

Fig. 9.1 System Characteristics



U(t)
Un
Short interference pulses w/ frequency bandwidth
Tn
t
Fig. 9.2a
S(f)
0 dB
-3 dB
Interference spectrum (normalized)
Spectrum for transmitted signal (normalized)
f
B
Bnom
Bn
Fig. 9.2b
CHOOSE : T ≤ Tn
Input bandpass filter
Dispersive delay line
SHORT PULSES
Signal
U(t)
Uout(t)
Receiver
Fig. 9.2c
Uout(t)
Time Despread signal representing a symbol
Time-spread broadband interference pulse
Us out=Us·√(B·T/n)
Un out < Un/√(B·T)
T
Tn
t
Δt
Us out/Un out > √n · Us/Un
oder
Ps out/Pn out > n · Ps/Pn
Fig. 9.2d

Fig. 9.2 BROADBAND INTERFERENCE

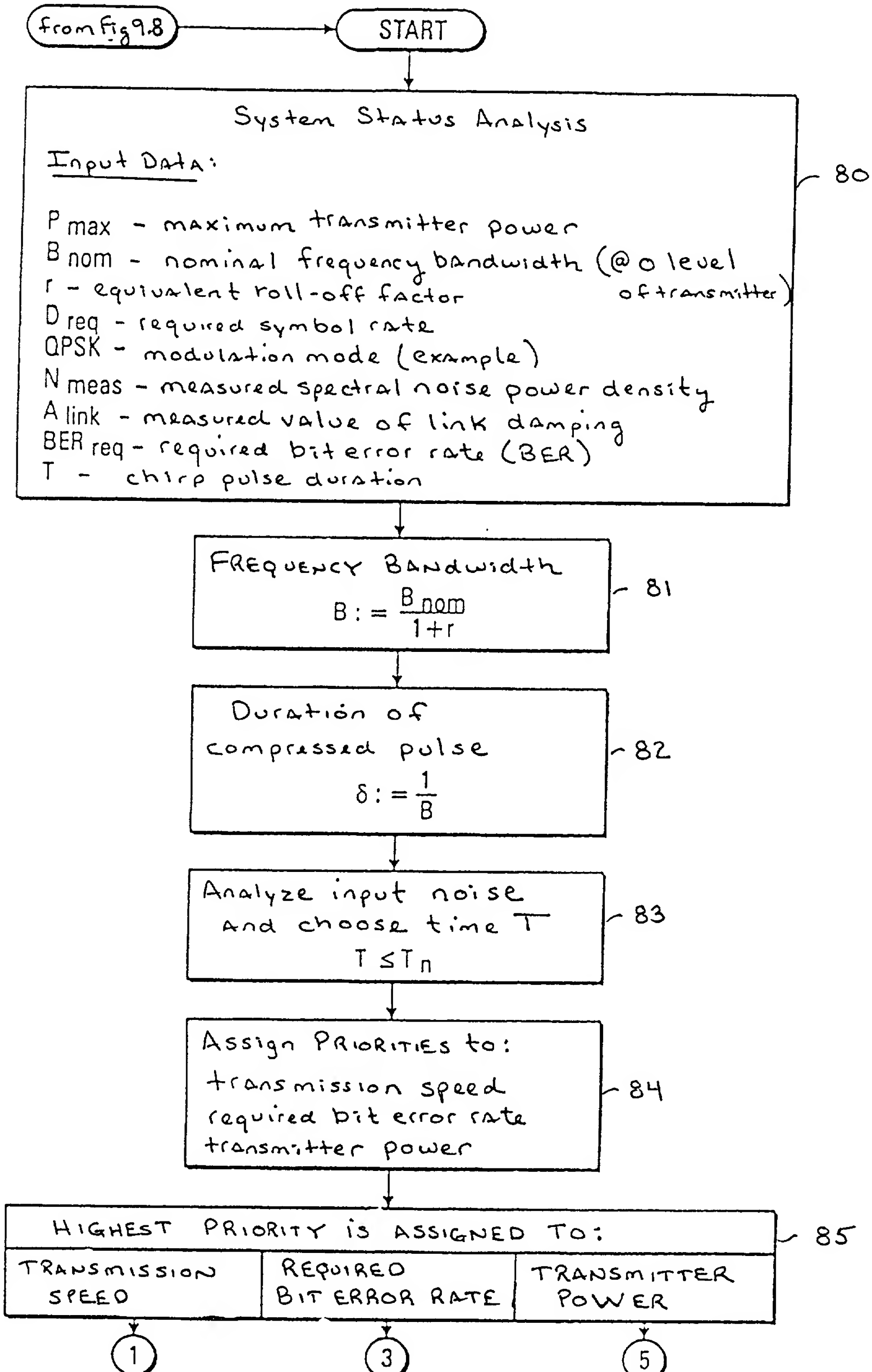

from Fig 9.8
START
System Status Analysis
Input Data:
P max - maximum transmitter power
B nom - nominal frequency bandwidth (@ o level of transmitter)
r - equivalent roll-off factor
D req - required symbol rate
QPSK - modulation mode (example)
N meas - measured spectral noise power density
A link - measured value of link damping
BER req - required bit error rate (BER)
T - chirp pulse duration
80
Frequency Bandwidth
B := B nom / 1+r
81
Duration of compressed pulse
δ := 1/B
82
Analyze input noise and choose time T
T ≤ Tn
83
Assign Priorities to:
transmission speed
required bit error rate
transmitter power
84
Highest priority is assigned to:
Transmission speed
Required bit error rate
Transmitter power
85
1
3
5

Fig. 9.3 Initialization & Priority Setting

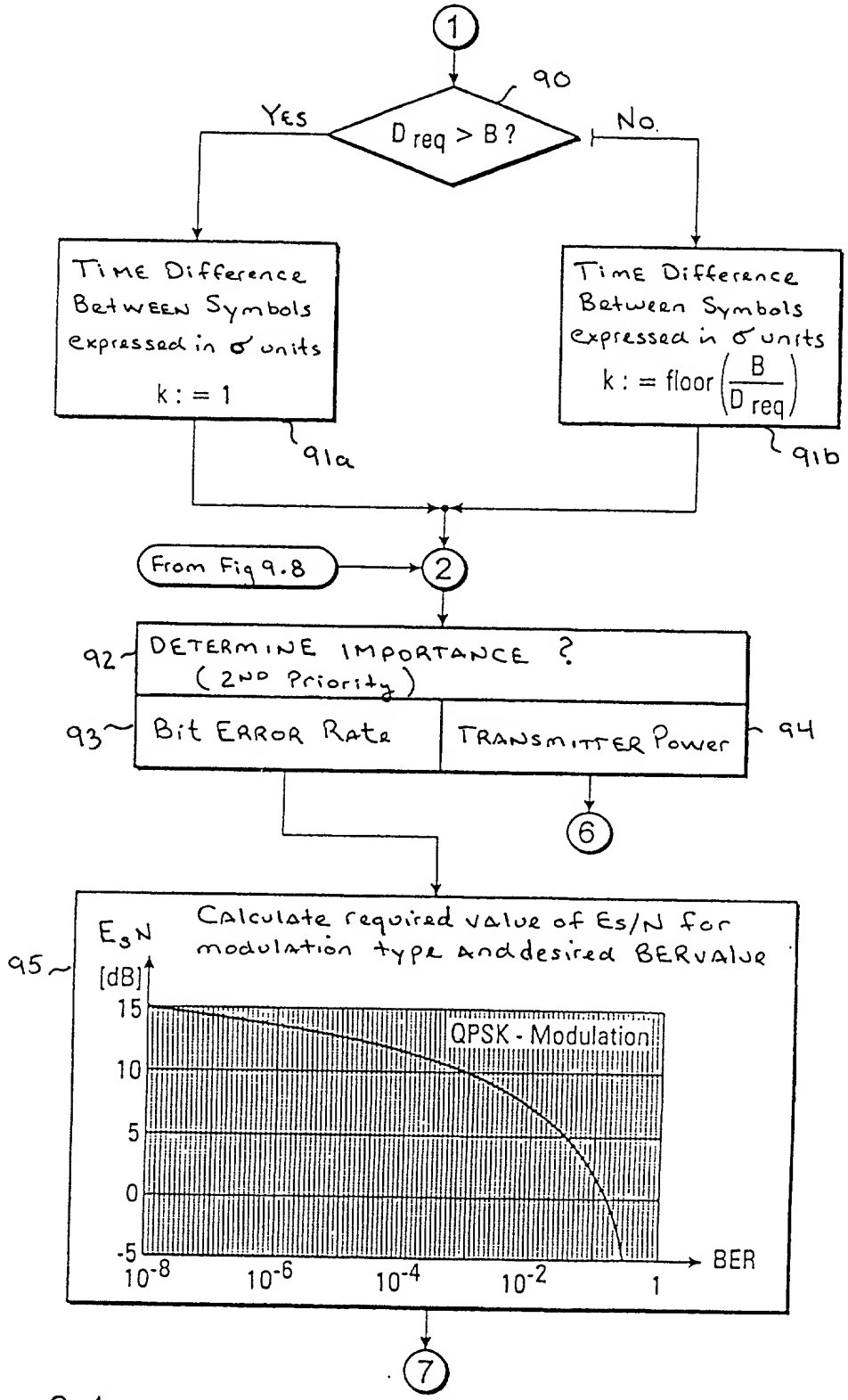


Fig. 9.4 Highest PRIORITY : TRANSMISSION Speed

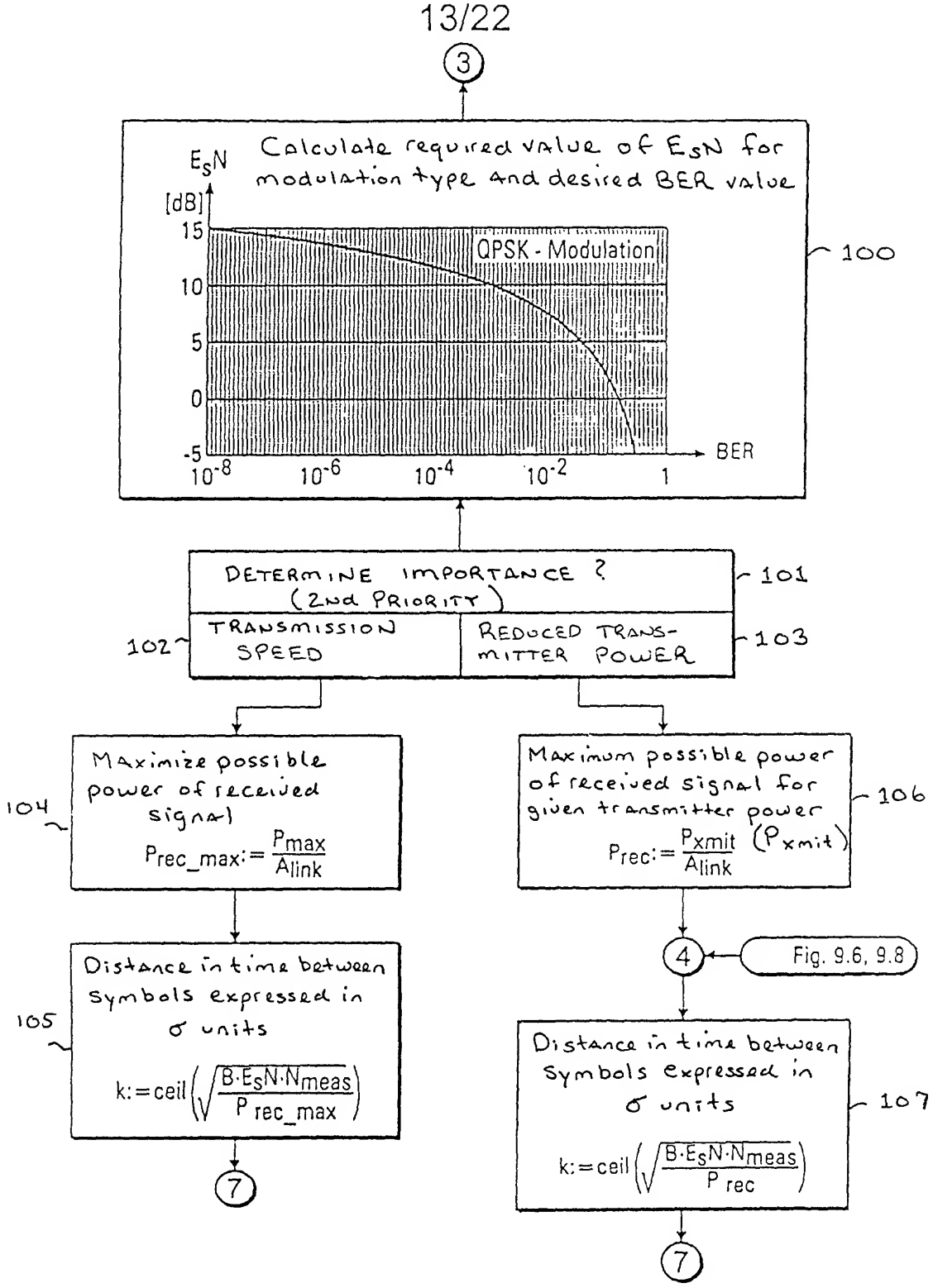


Fig. 9.5: Highest priority for: Required Bit Error Rate

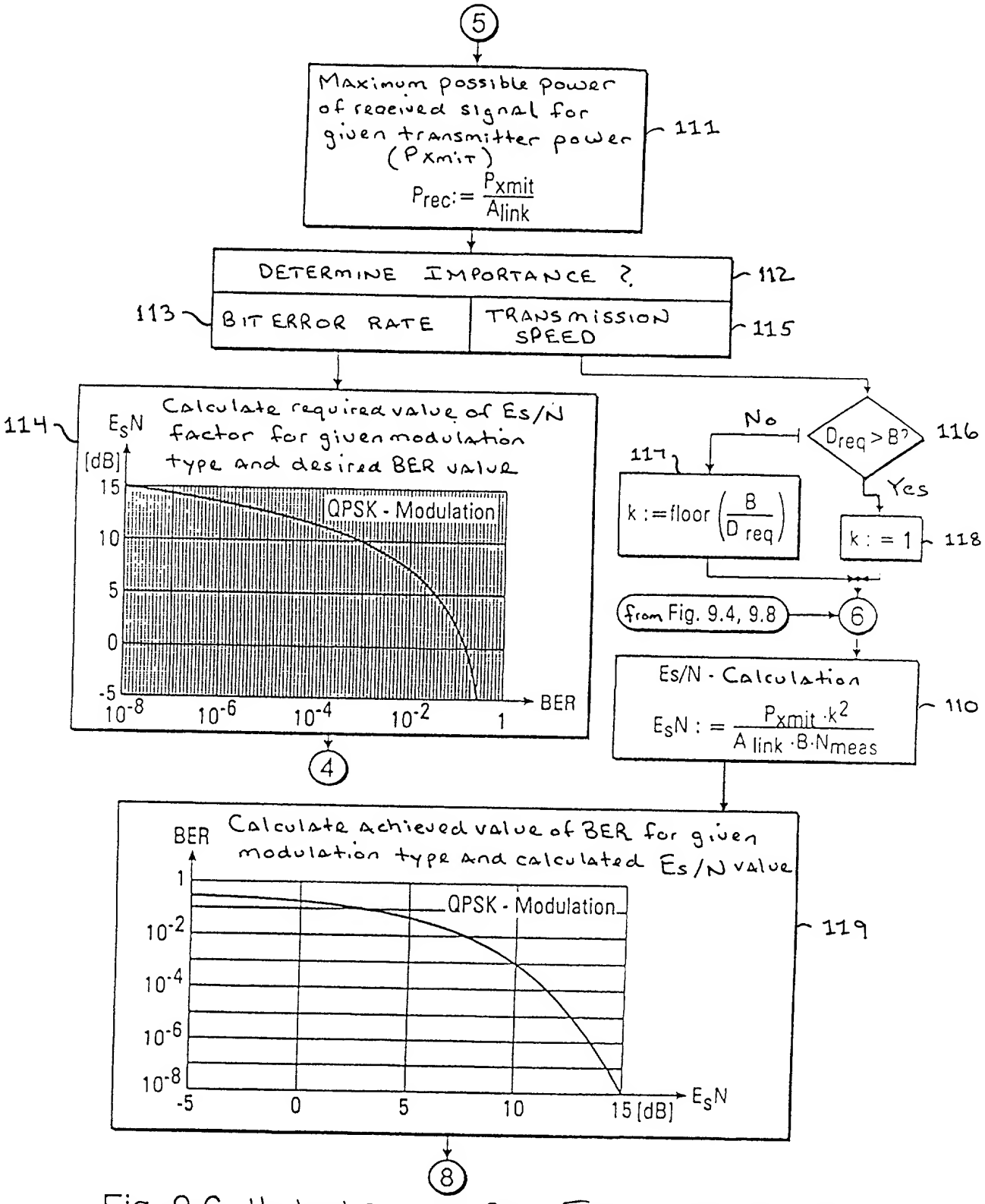


Fig. 9.6 Highest Priority for: TRANSMITTER POWER

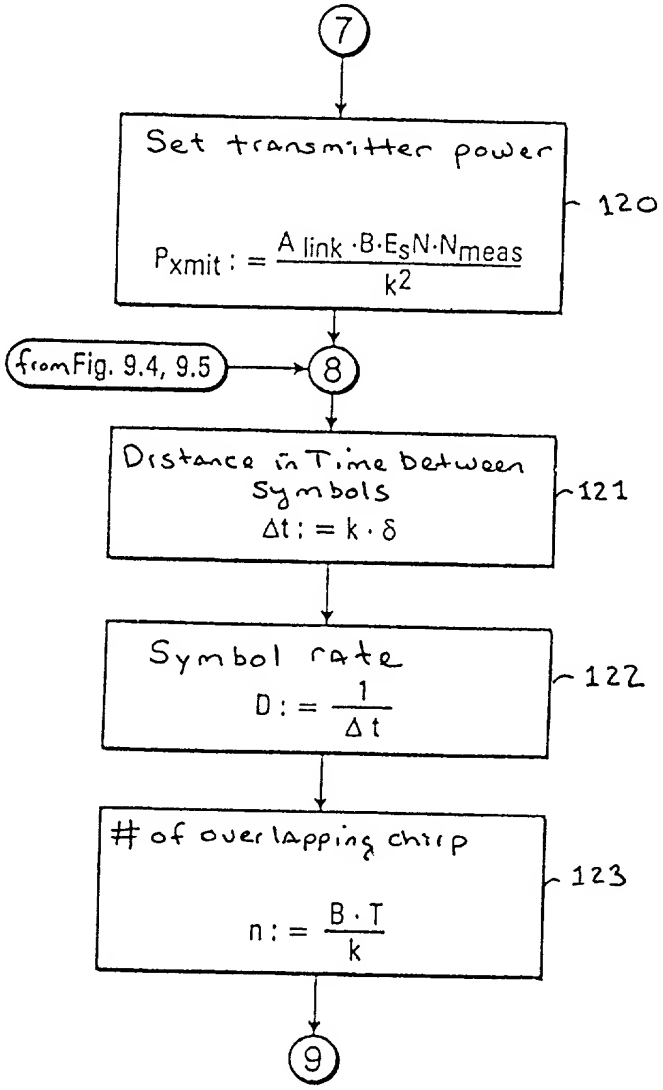


Fig. 9.7 System Parameters

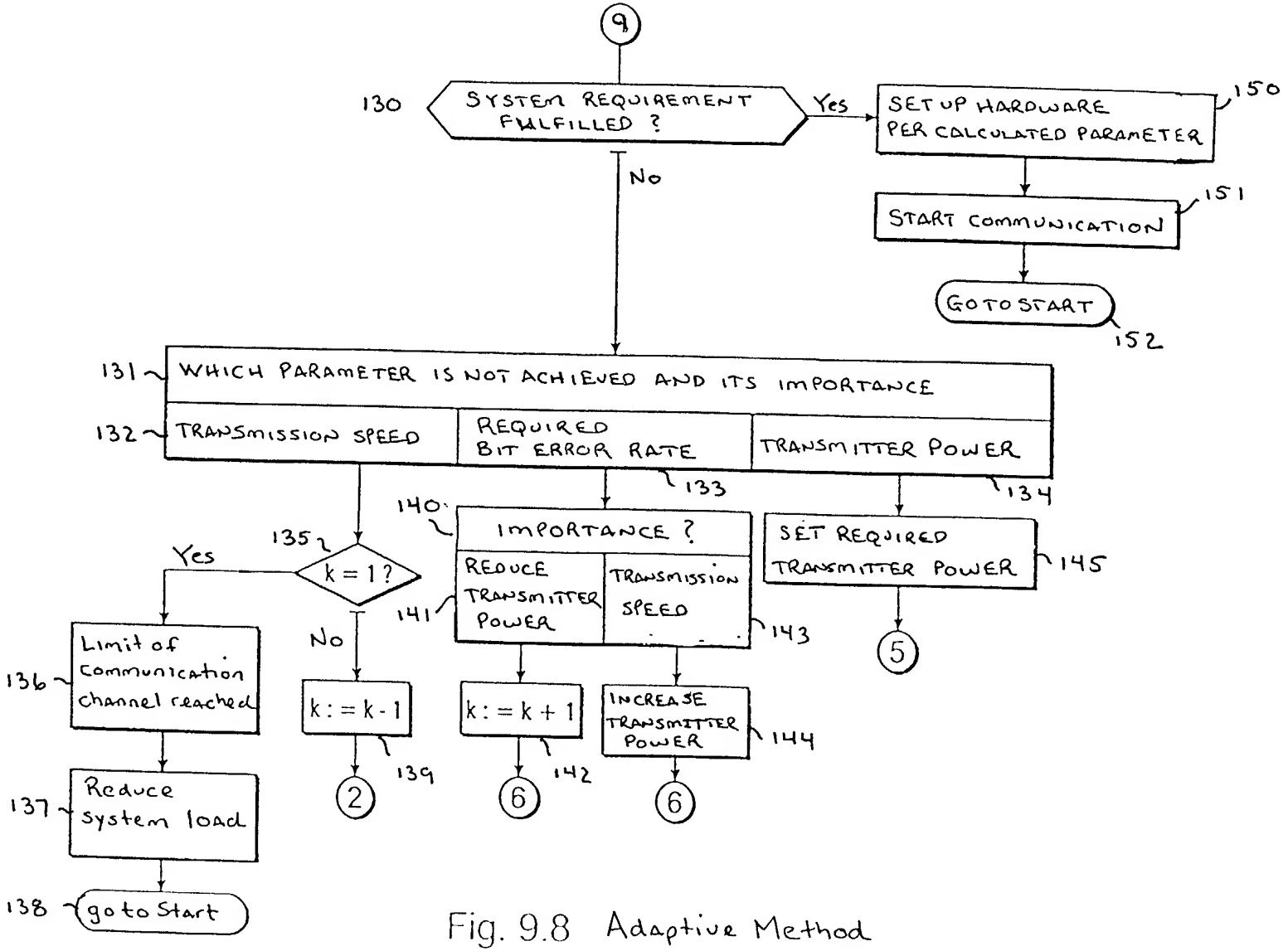


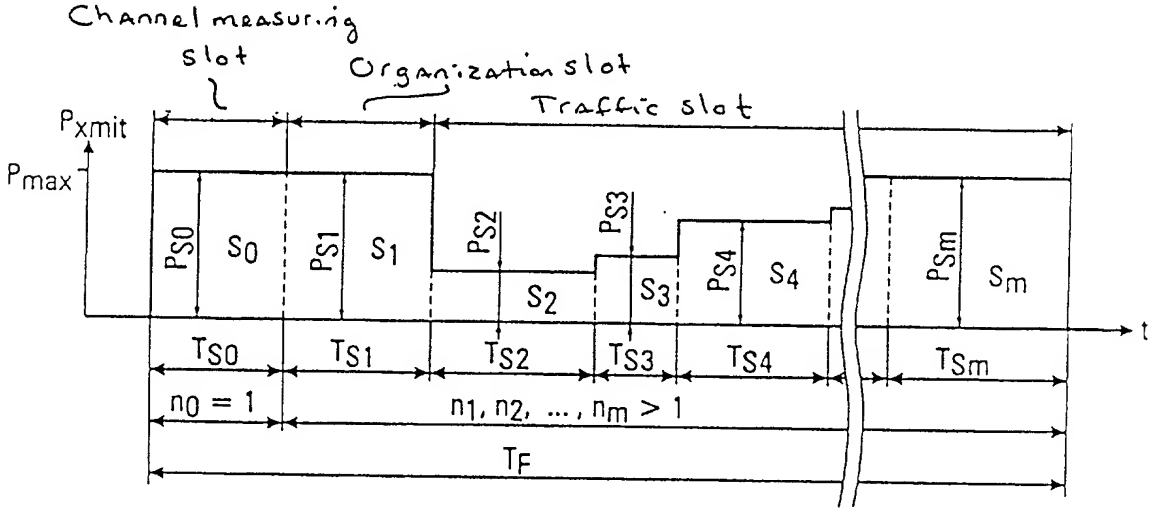
Fig. 9.8 Adaptive Method

Resource Allocation -

arranged and controlled on the time axis enabling full system capacity to be used at all times to provide best efficiency

Example of Resource Allocation in TDMA Systems:

Allocated resources are: signal power for each time slot, duration of each time slot



where:

$n_0, n_1, n_2 \ldots n_m$	-	number of overlapping pulses for time slots
P_{MAX}	-	maximum transmitter power
$P_{s0}, P_{s1}, P_{s2} \ldots P_{sm}$	-	Assigned transmitter power per time slot
S_0	-	time slot 0 Assigned to time equalization method
S_1	-	time slot 1 Assigned to the organization channel
S_2	-	time slot 2 Assigned to the first traffic channel
S_3	-	time slot 3 Assigned to the second traffic channel
S_4	-	time slot 4 Assigned to the third traffic channel
S_m	-	time slot m Assigned to the last traffic channel

T_F = frame duration

$$T_F = \sum_{i=0}^{m} T_{Si}$$

$T_{s0}, T_{s1}, T_{s2} \ldots T_{sm}$ = duration of time slots 0, 1, 2, ... m

Fig. 9.9 Resource Allocation for Sampling System w/ TDMA

Example of received signal according to the time-despreading method
For resources allocated as in Fig 9.9.

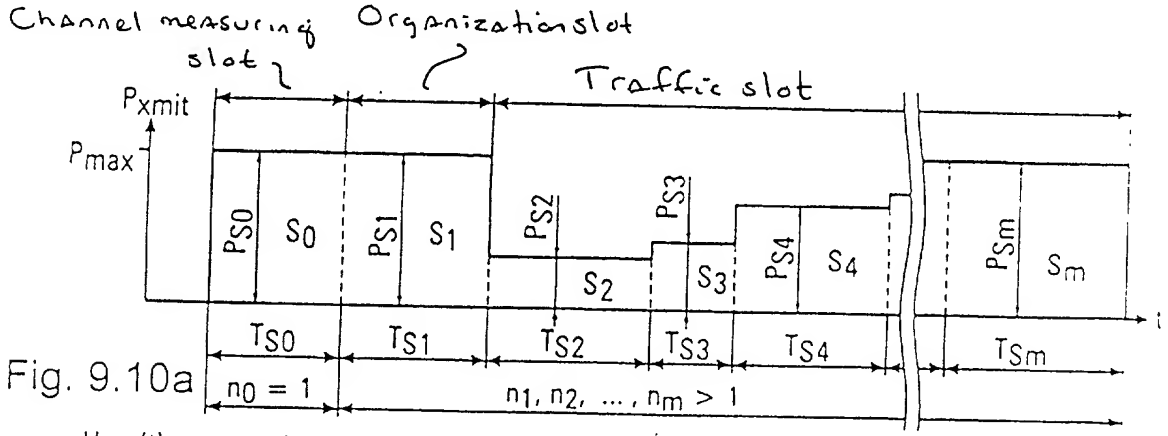


Fig. 9.10a

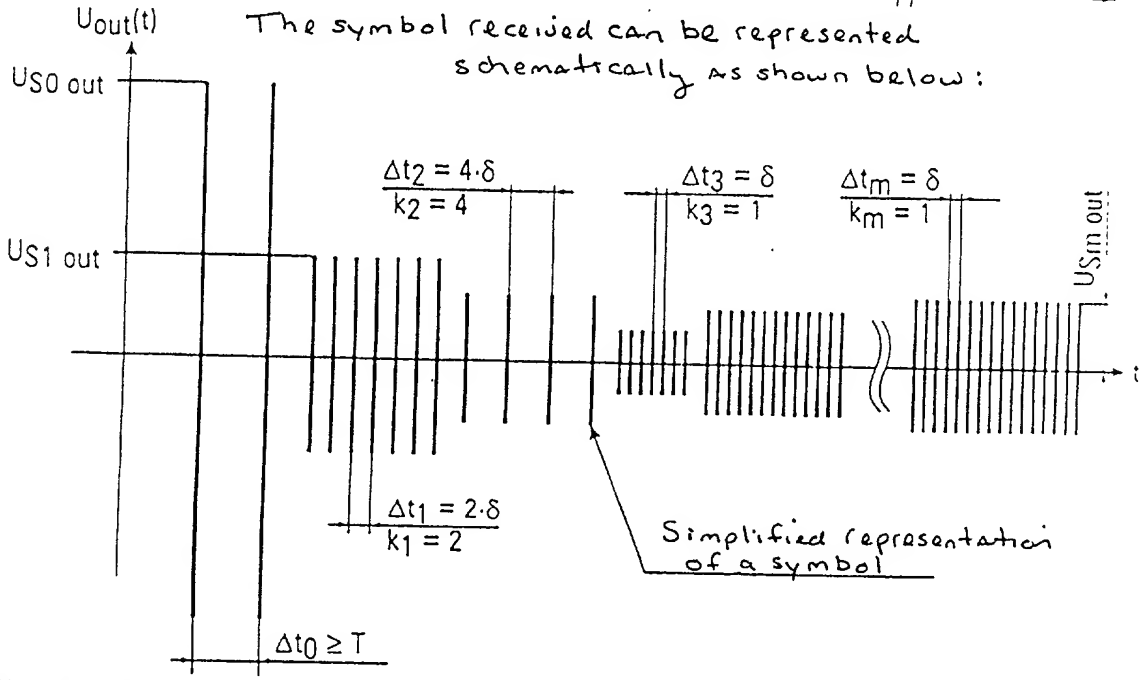
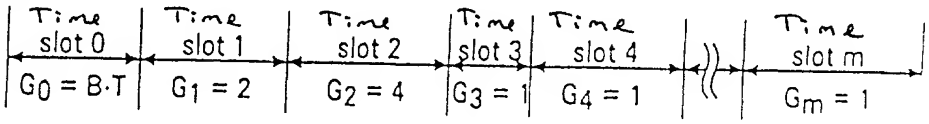


Fig. 9.10b



$$G_i = \frac{B \cdot T}{n_i}; \quad i = 0, 1, 2, \ldots, m$$

$$U_{Si\,out} = \sqrt{G_i \cdot \frac{P_{Si} \cdot R_0}{A_{link\,i}}} = \sqrt{\frac{B \cdot T \cdot P_{Si} \cdot R_0}{n_i \cdot A_{link\,i}}}$$

Fig. 9.10 Example of Received Signal

Example of received signal according to the time-despreading method (contd.)

where:

Alink 0, Alink 1, ..., Alink m - damping of transmitter ⟷ receiver link and the effective frequency bandwidth of the system for time slots 0, 1, 2, ... m

$G_0, G_{S1}, G_2, \ldots, G_m$ - Additional system gain for timeslots 0, 1, 2, ... m

$k_0, k_1, k_2, \ldots, k_m$ - distance between symbols (expressed as integral multiples of the σ time) for time slots 0, 1, 2, ... m

R_0 - nominal value of the load resistance

T - duration of chirp signal

$\Delta t_0, \Delta t_1, \Delta t_2, \ldots, \Delta t_m$ - intersymbol distance for timeslots 0, 1, 2 ... m

$U_{S0\ out}, U_{S1\ out}, \ldots, U_{Sm\ out}$ - Amplitude of the de-spread symbol for time slot number 0, 1, 2, ... m (e.g. output of the dispersive delay line → see Fig 9.2)

B - effective frequency bandwidth of the system.

$$U_{S0\ out} = \sqrt{\frac{B \cdot T \cdot P_{S0} \cdot R_0}{\text{Alink } 0}}$$ Pulse Amplitude for channel equalization method

$$U_{S1\ out} = \sqrt{\frac{2 \cdot P_{S1} \cdot R_0}{\text{Alink } 1}}$$ Symbol Amplitude for the organization channel

$$U_{S2\ out} = \sqrt{\frac{4 \cdot P_{S2} \cdot R_0}{\text{Alink } 2}}$$ Symbol Amplitude for the first traffic channel

$$U_{S3\ out} = \sqrt{\frac{1 \cdot P_{S3} \cdot R_0}{\text{Alink } 3}}$$ Symbol Amplitude for the second traffic channel

$$U_{S4out} = \sqrt{\frac{1 \cdot P_{S4} \cdot R_0}{\text{Alink } 4}}$$ Symbol Amplitude for the third traffic channel

$$U_{Sm\ out} = \sqrt{\frac{1 \cdot P_{Sm} \cdot R_0}{\text{Alink } m}}$$ Symbol Amplitude for the last traffic channel

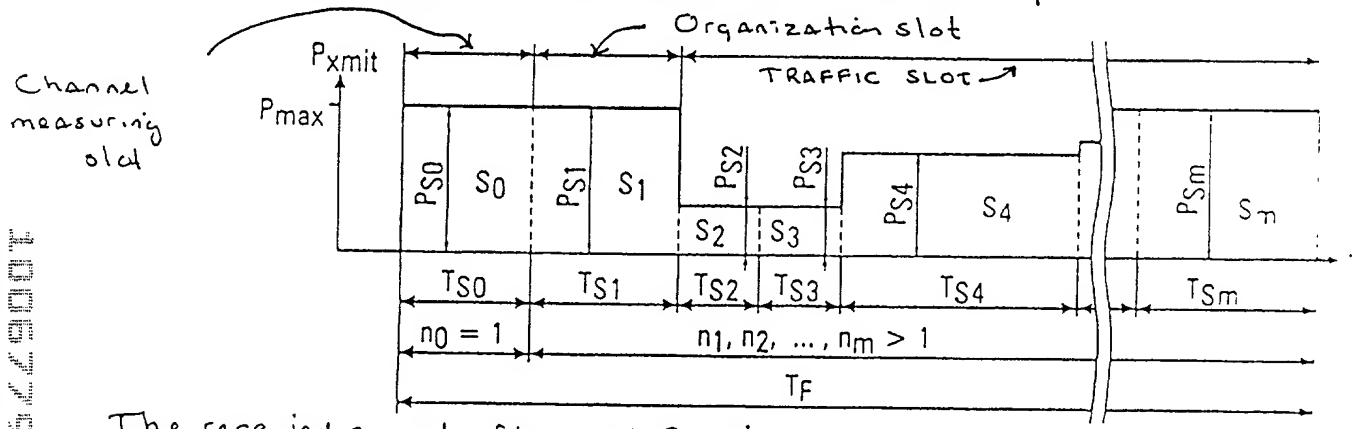
Fig. 9.11 Example of Received Signal (contd.)

Modified allocation of resources according to changed system Requirements

→ less time allocated for time slot S_2 and S_3

→ less transmitter power allocated for time slot S_3

→ more time allocated for time slot S_4



The received signal after modification can be represented schematically as shown below:

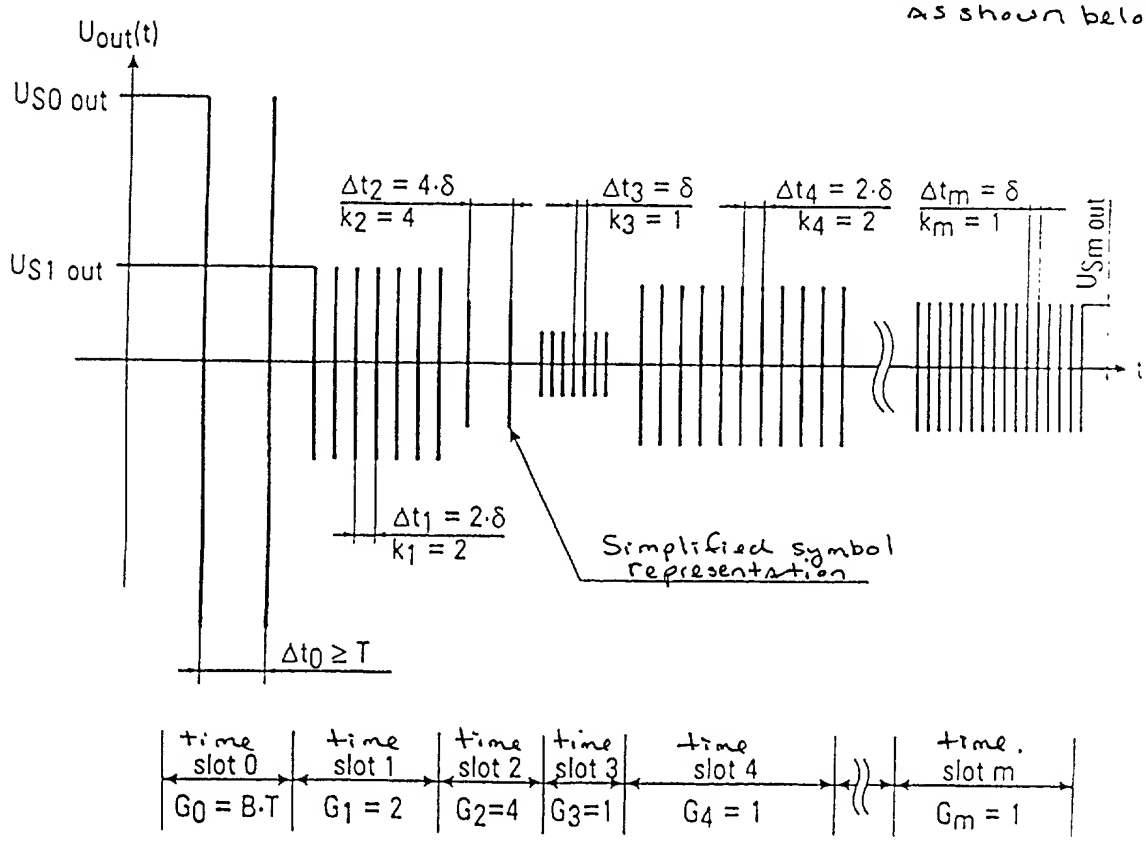


Fig. 9.12 RE-ALLOCATION OF RESOURCES

Example of Received Signal After Allocation of resources (contd.)

Amplitude of the time-despread signal

$U_{S0\,out} = \sqrt{\dfrac{B \cdot T \cdot P_{S0} \cdot R_0}{A_{link\,0}}}$ Pulse amplitude for channel equalization method

$U_{S1\,out} = \sqrt{\dfrac{2 \cdot P_{S1} \cdot R_0}{A_{link\,1}}}$ Symbol amplitude for the organization channel

$U_{S2\,out} = \sqrt{\dfrac{4 \cdot P_{S2} \cdot R_0}{A_{link\,2}}}$ Symbol amplitude for the first traffic channel

$U_{S3\,out} = \sqrt{\dfrac{1 \cdot P_{S3} \cdot R_0}{A_{link\,3}}}$ Symbol amplitude for the second traffic channel

$U_{S4out} = \sqrt{\dfrac{2 \cdot P_{S4} \cdot R_0}{A_{link\,4}}}$ Symbol amplitude for the third traffic channel

$U_{Sm\,out} = \sqrt{\dfrac{1 \cdot P_{Sm} \cdot R_0}{A_{link\,m}}}$ Symbol amplitude for the last traffic channel

Fig. 9.13 RE-Allocation of Resources (contd.)

END OF POWER Envelope for the transmitted signal after Time - Spreading

Power envelope for the specification of Fig 9.9.

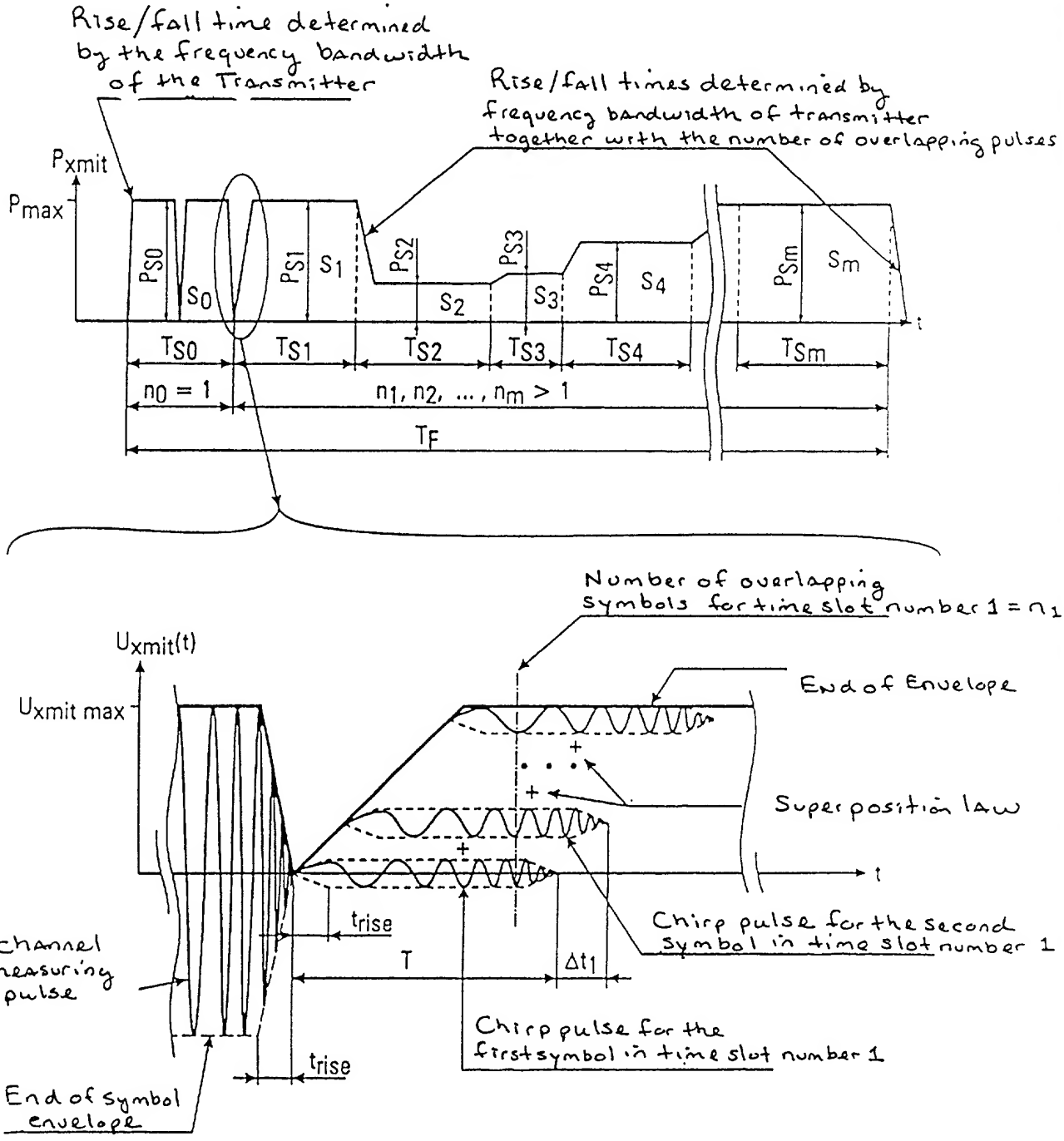


Fig. 9.14 Chirp Pulse Overlapping